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(54) Remote location monitoring

(57) A location monitoring apparatus comprises a plurality of GPS mobile location monitoring units, one or more ground stations and a cellular telephone communications link between the mobile location monitoring unit and the ground station. Each ground station is arranged to receive location information from one or more of the mobile units corresponding to the location of that mobile unit. Each ground station is capable of identifying the location of the mobile units on a geographical map stored by the ground station or by a general geographical address system.

Application is to monitoring vehicles' positions.

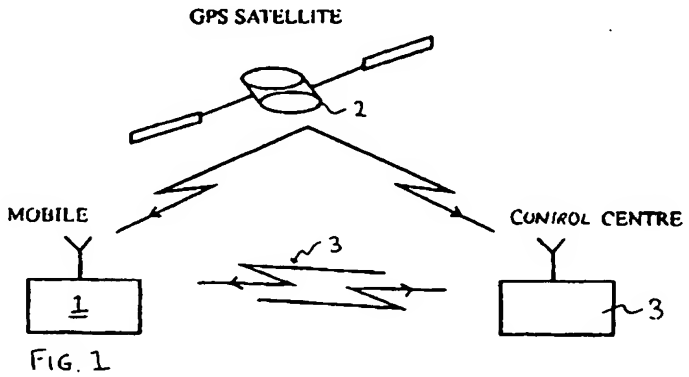

FIG. 1

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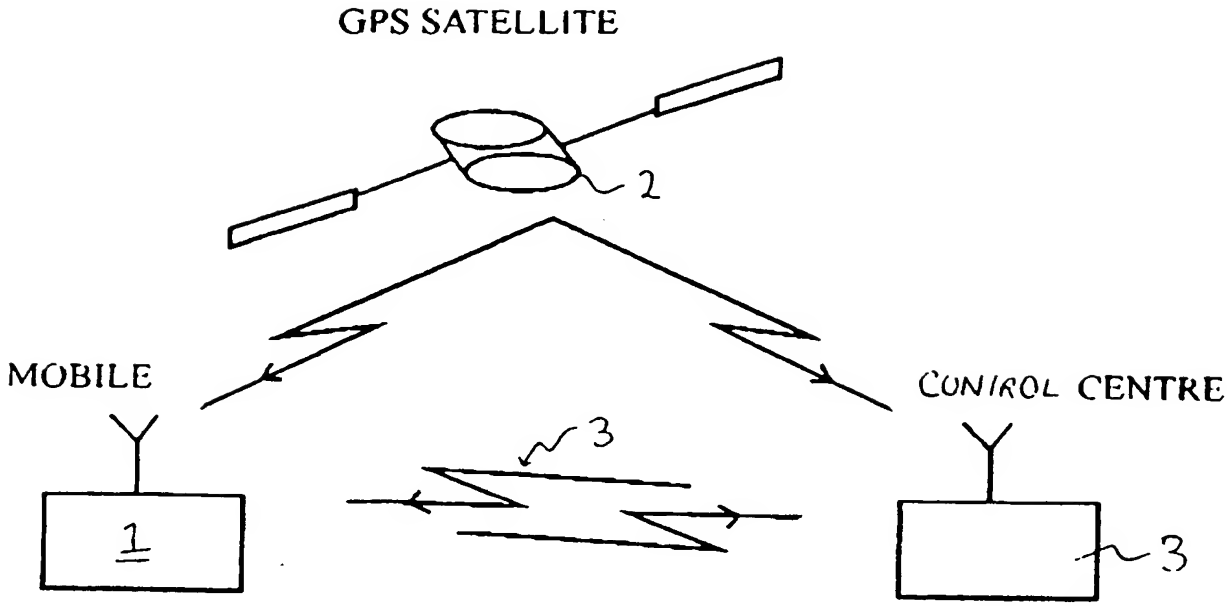

FIG. 1

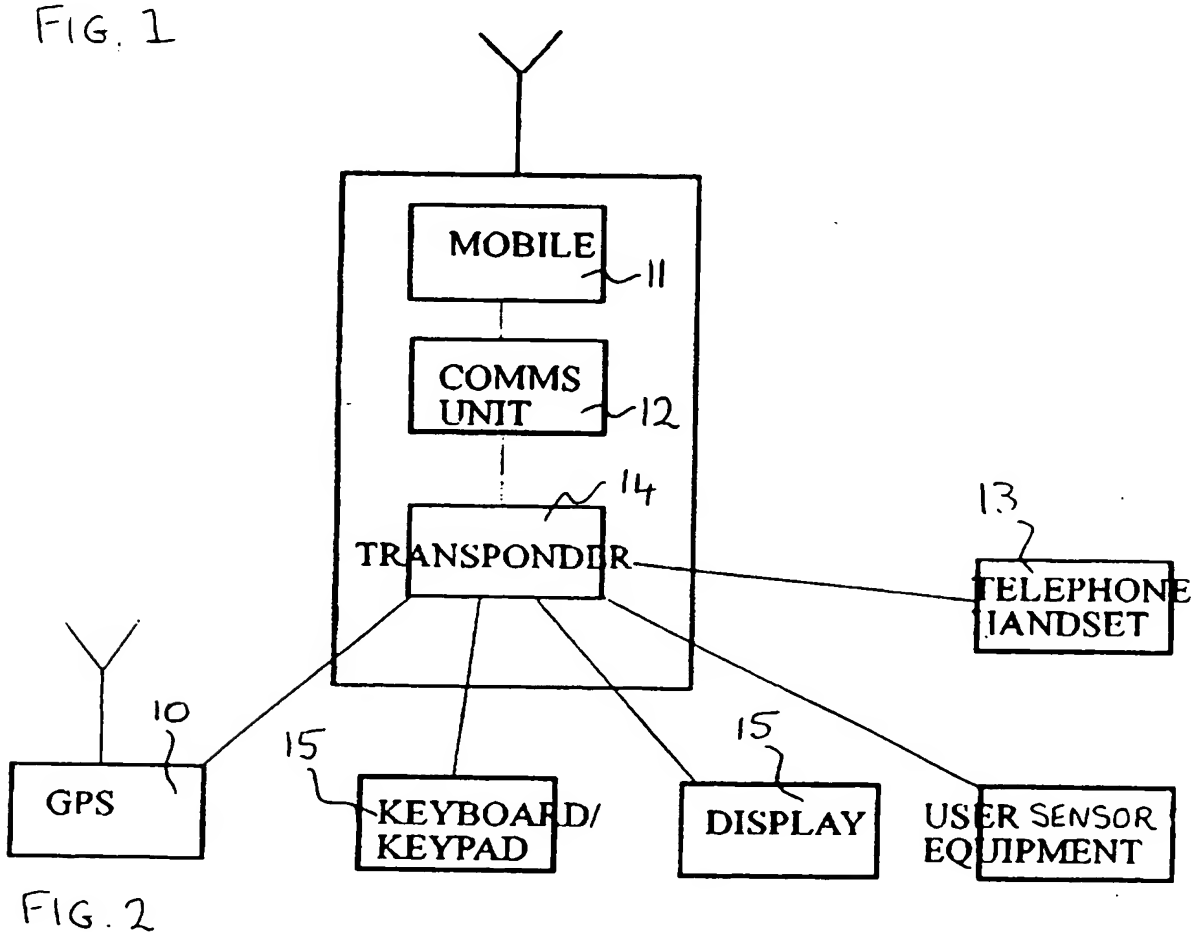

FIG. 2

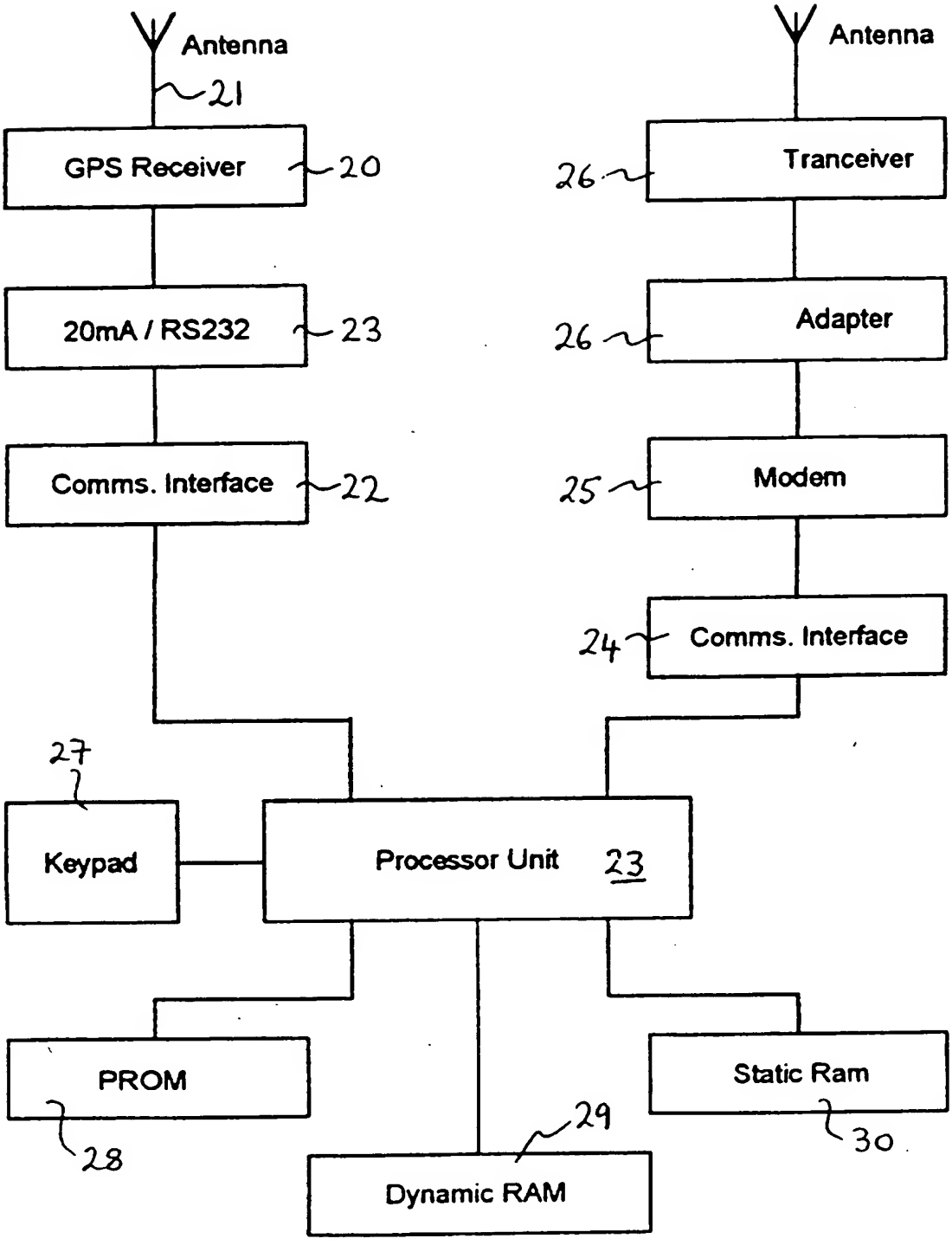

FIG. 3

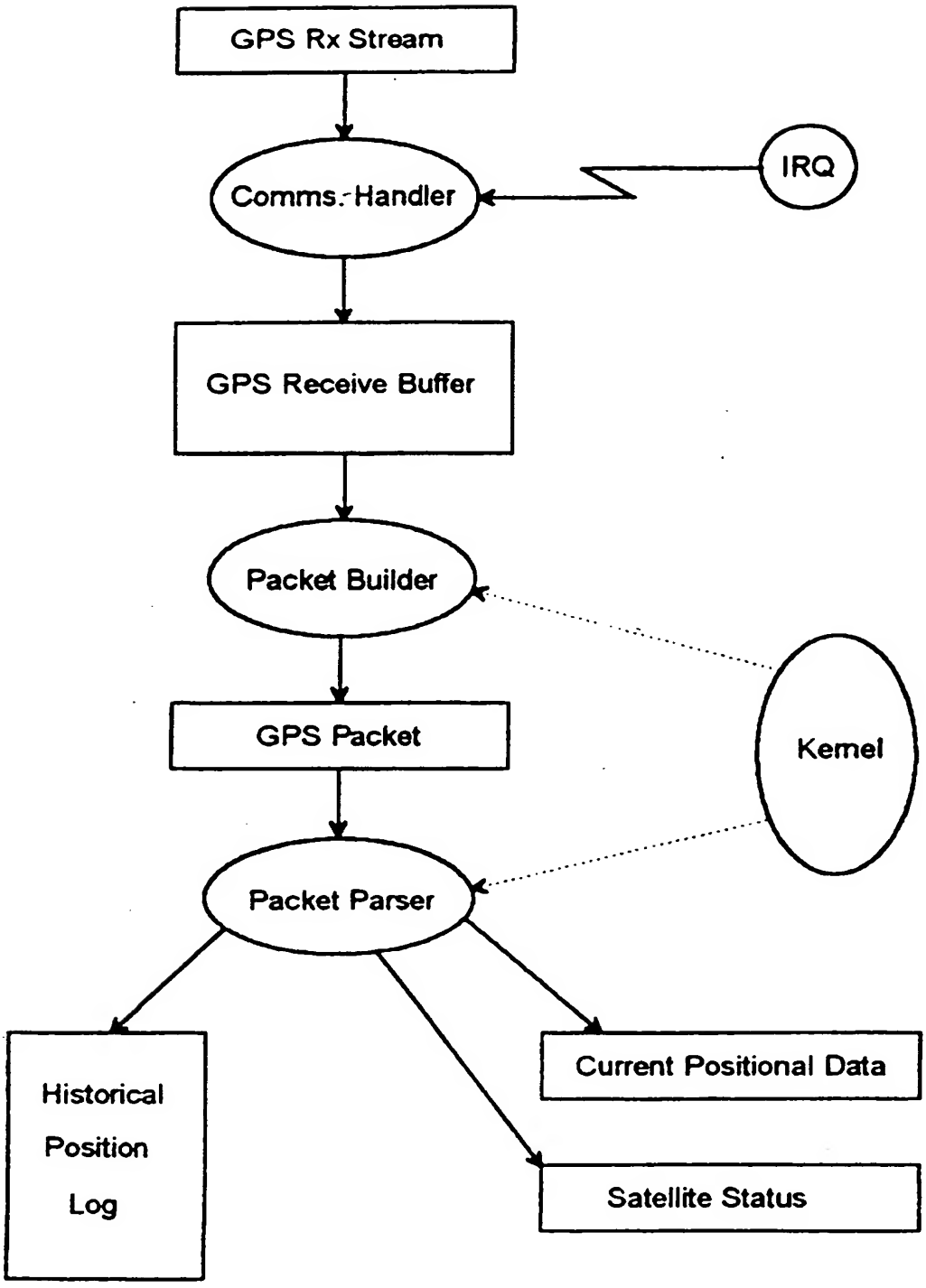

FIG. 4

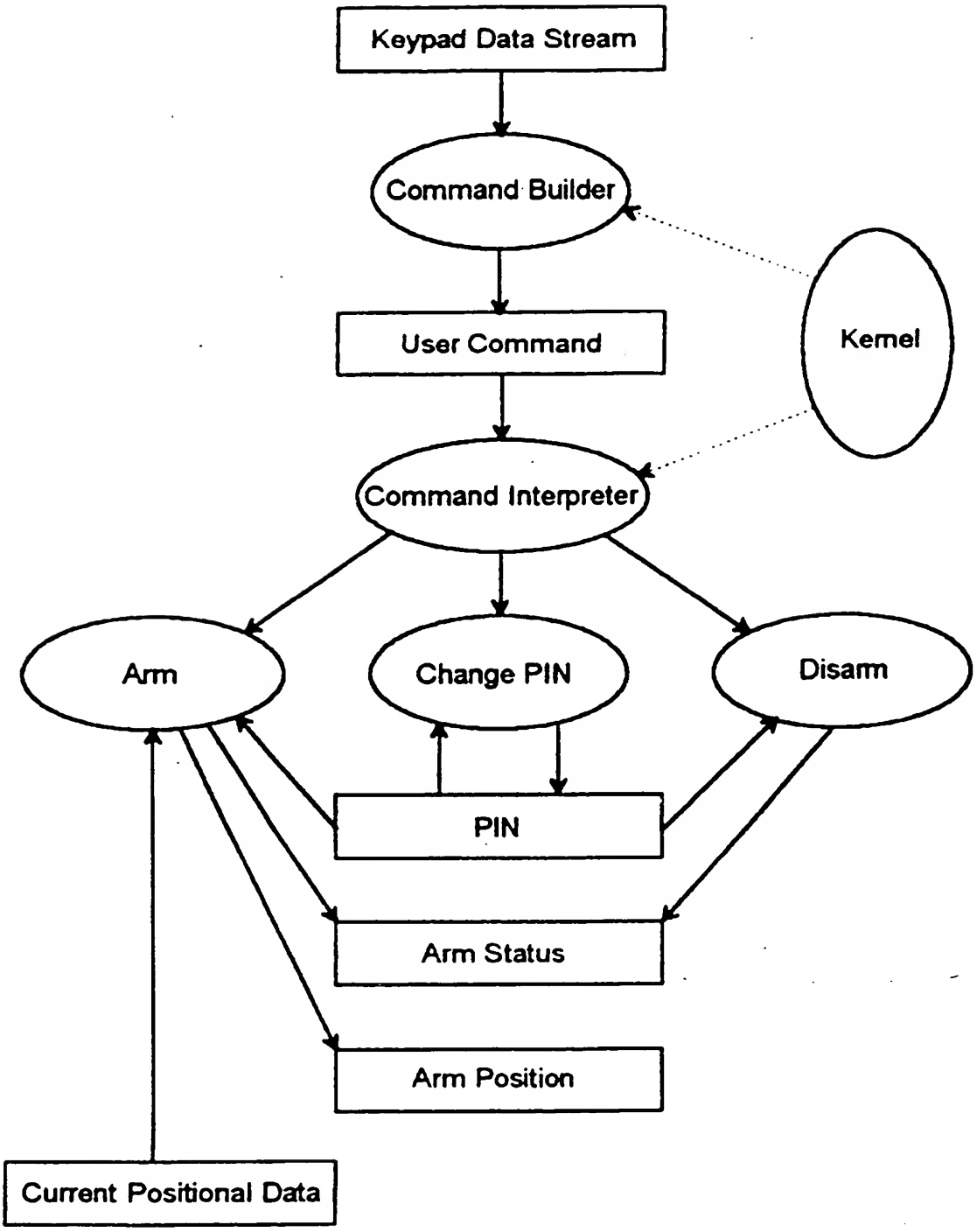

FIG. 5

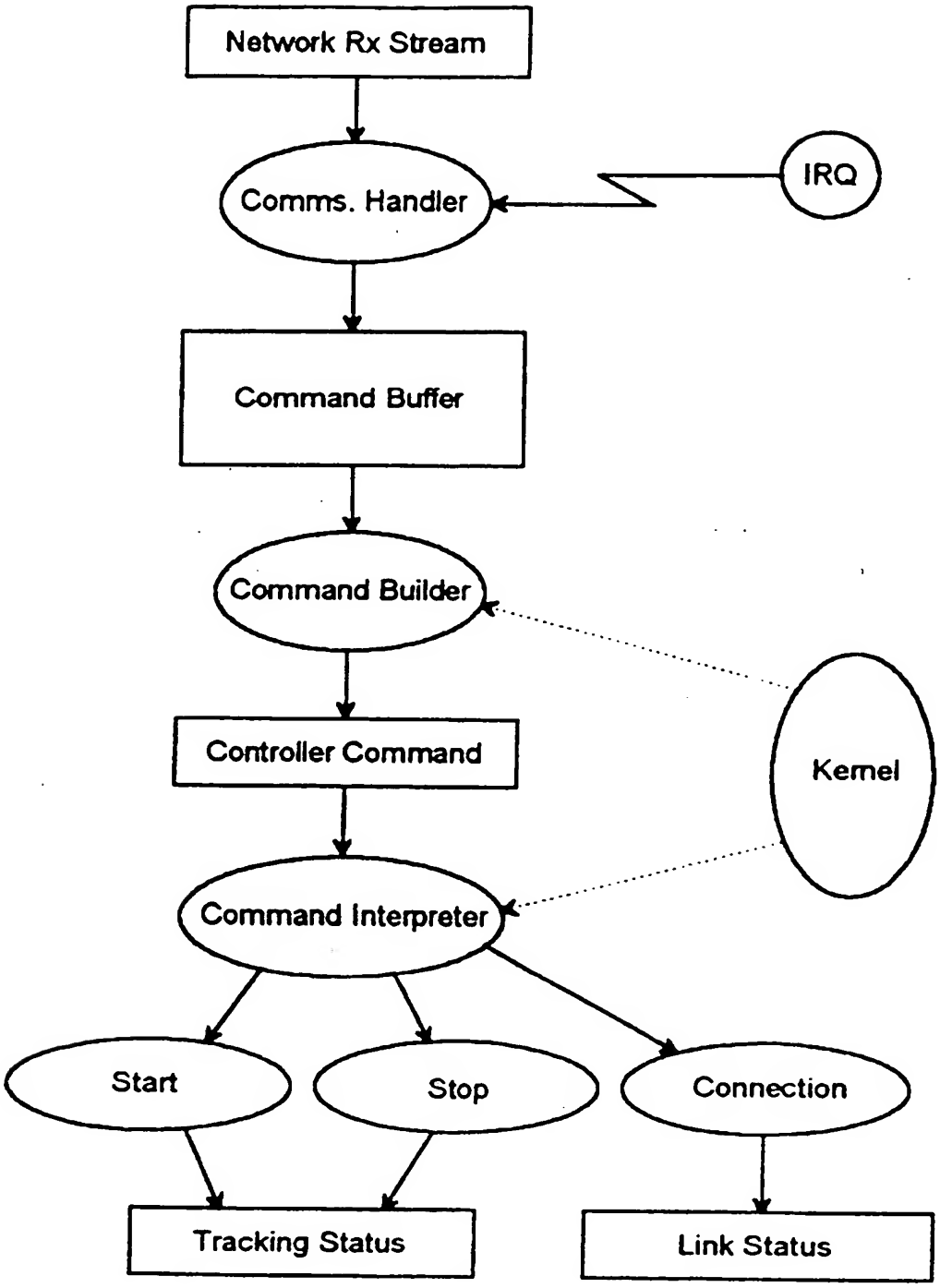

FIG. 6

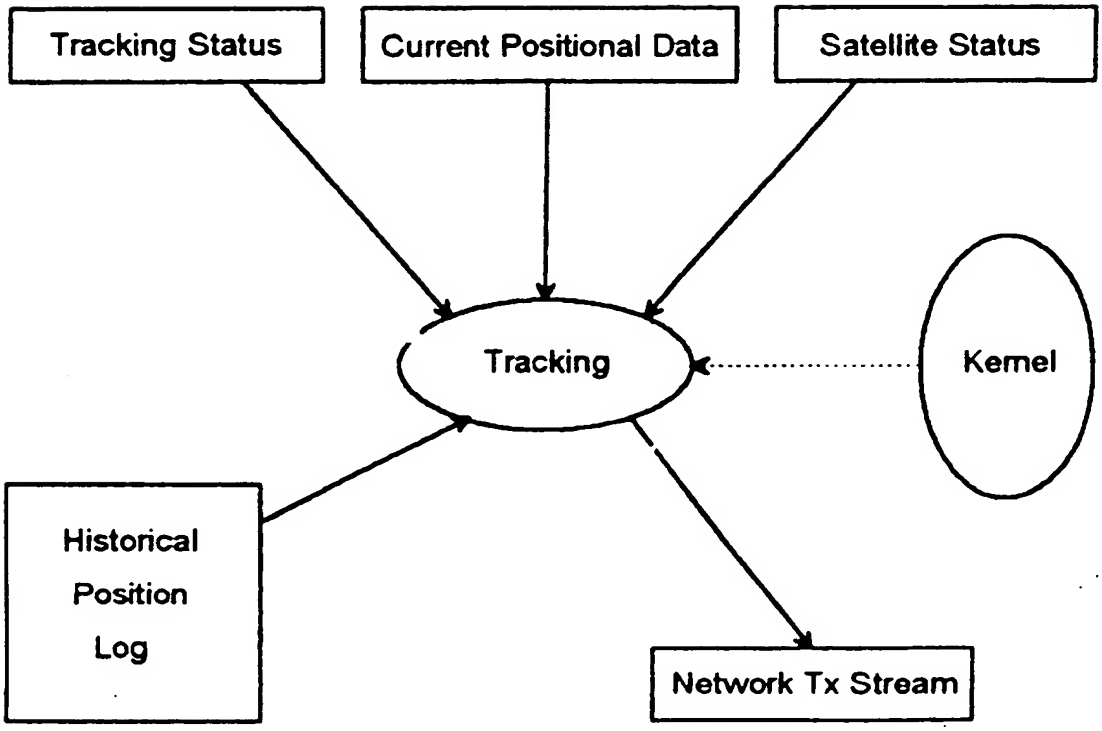

FIG.7

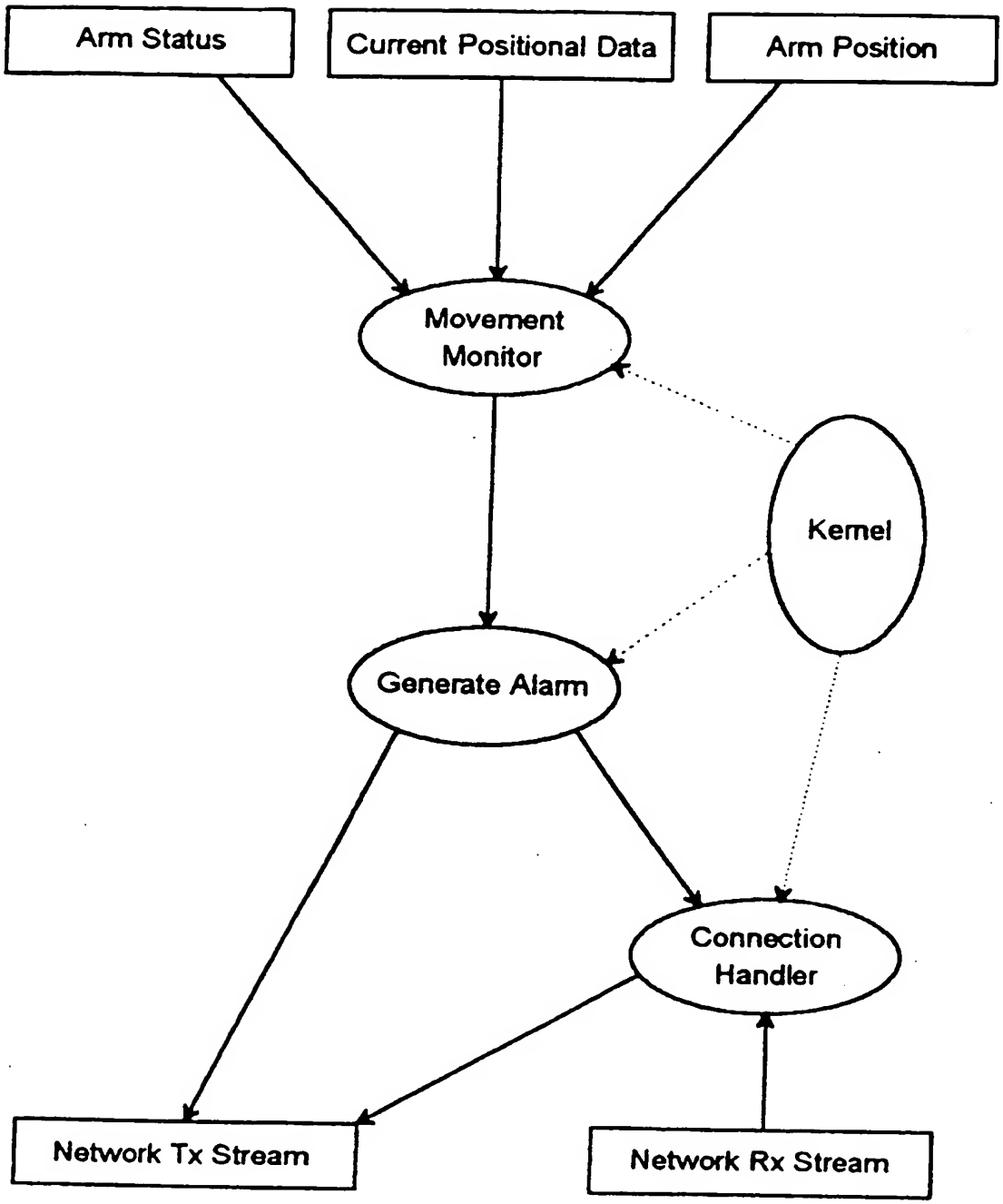

FIG. 8

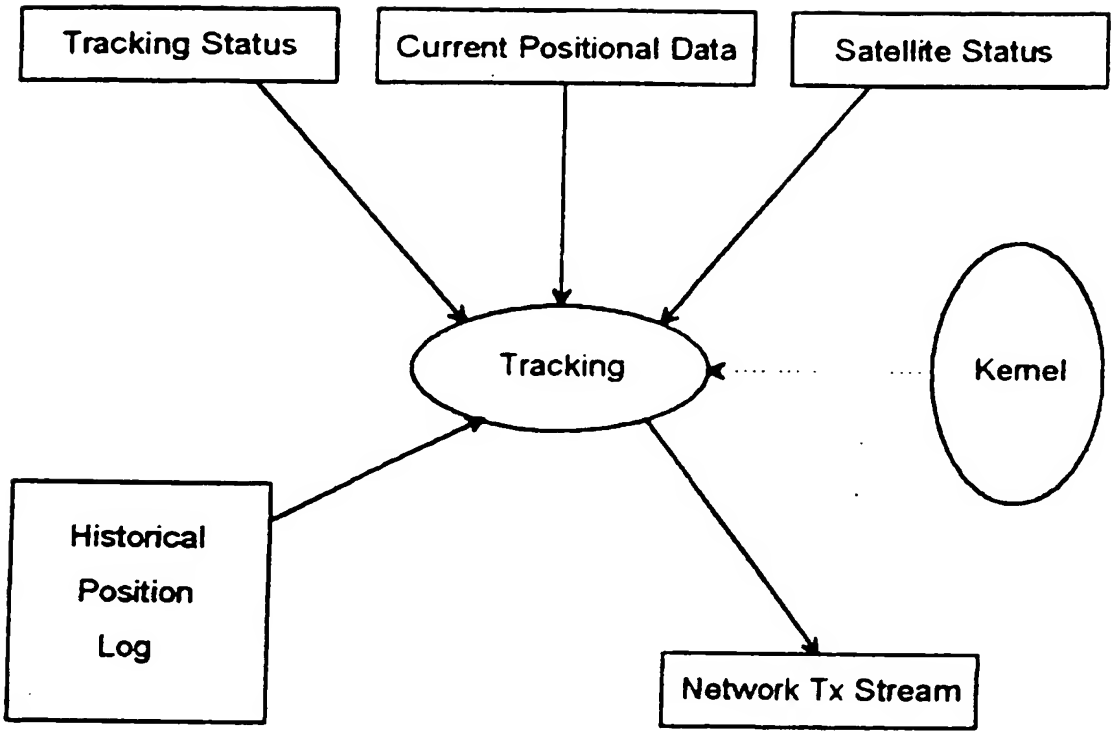

FIG. 9

REMOTE LOCATION MONITORING

The present invention relates to the field of communications, and particularly although not exclusively to a method and apparatus for remotely monitoring the geographical location of a mobile location monitoring unit.

The conventional global positioning system (GPS) is well known as a navigational aid for use in marine applications. The conventional GPS apparatus including a satellite in geostationary orbit, and a ground based receiver, is capable of accurately determining a positional location to within an order of centimetres, at most locations over the earth surface.

Specific embodiments and specific methods of the present invention aim to provide means for communicating and utilising the positional information available from the conventional GPS apparatus and system to provide a range of monitoring and/or information services. Typical applications which are addressed by specific embodiments and methods of the present invention include

(i) real time tracking of stolen items;

(ii) monitoring movement of the above mentioned items;

(iii) monitoring of train journey progress;

(iv) monitoring emergency call outs from within a vehicle;

(v) road traffic accident analysis; and

(vi) despatch of customer specific requests.

The above applications are examples only, and the invention is not restricted to the above applications but will find broader use in general.

According to one aspect of the present invention there is provided a location monitoring apparatus characterised by comprising:

(i) a plurality of mobile location monitoring units;

(ii) one or a plurality of ground stations;

(iii) a communications link between the mobile location monitoring unit and the ground station(s);

wherein each ground station is arranged to receive location information from one or more of the mobile location monitoring units, said location information corresponding to the location(s) of said respective mobile location monitoring unit(s), and

each said ground station is capable of identifying the location(s) of the one or more said mobile location monitoring unit(s) on a geographical map stored by the ground station and/or of identifying said location(s) by general post office addressing.

Preferably, the geographical map is presented as a map image. Preferably the ground station is capable of displaying the location(s) of the one or more mobile monitoring units on the image of the geographical map.

By providing a ground station on which an image of a map is displayed, the location of one or more mobile location monitoring units may be displayed on the map image, allowing monitoring of the mobile location monitoring units.

Preferably said location information is communicable between the mobile location monitoring unit(s) and the ground station(s) substantially in real time.

At the ground station, which preferably comprises a computer adapted to receive the location information via the chosen communications link, various information may be determined from the movement of the mobile location monitoring units, for example the speed and direction of a particular mobile location monitoring unit may be calculated in real time, the history of the movement of each of the mobile location monitoring units may be recorded, downloaded and stored.

A said mobile location monitoring unit may be capable of storing location information relating to the location of that mobile location monitoring unit, and communicating said location information to the ground station(s) on request from a said ground station.

Preferably a said ground station comprises a database of information. Said information may be selectively accessible from a said mobile location monitoring unit via said communications link.

Preferably, each said mobile location monitoring unit is capable of storing an identification code uniquely identifying said particular mobile location monitoring unit, and is arranged to transmit said unique identifying

code along with said location information, and any relevant customer request related information.

According to a second aspect of the present invention there is provided a mobile location monitoring unit comprising:

(i) a location identification means for identifying a geographical location of the unit and for generating a location information corresponding to said geographical location;

(ii) a communication means for communicating a location information with one or a plurality of ground stations; and

(iii) a control means for controlling the communication means for communicating the location information with the one or plurality of ground stations.

Preferably, said location identification means for identifying a geographical location comprises a receiver capable of receiving satellite navigation signals.

The location identification means may comprise a receiver capable of locating a position in relation to an existing node network of a cellular telephone network.

Preferably, said communication means comprises an interface capable of connecting to a communications link, such as a cellular telephone network.

The mobile location monitoring unit may comprise a recorder for recording the location information.

Preferably, said recorder comprises a semi conductor memory.

The location identification means may operate to supply the location information to the recorder and/or the communication means substantially continuously.

The recorder may operate to record the location information at predetermined times.

The recorder may operate to record the location information at regular time intervals.

The recorder may operate to hold customer specific information. For example, the recorder could store details of veterinary preparations in a situation where the mobile location monitoring unit is fitted to a veterinary surgeon's personal car.

Preferably, the control unit operates to activate the communications means to communicate the location information to the one or plurality of ground stations at predetermined regular time intervals.

Said control unit may operate to activate the communications link such as to produce substantially continuous transmission of the location information to the one or plurality of ground stations. The control unit may deactivate the communications link in order to conserve power.

Said control unit may be arranged to operate the recorder means so as to record said location information together with a time information such that there is recorded:

(i) a location information relating to a set of separate locations in which the unit has been present; and

(ii) a time information comprising a separate time period information relating to each of the said separate locations, such that for each said location at which the unit has visited, there is recorded a respective time period over which the unit remained at the location.

The location information, time information and identification information may be communicated to a said ground station under the control of the control unit. The location, time and identification information may be communicated to the ground station upon receipt of a request generated by the ground station.

Preferably, said ground station comprises a computer.

Preferably, said computer comprises a database containing information relating to a set of items and a plurality of the mobile location monitoring units, each said mobile location monitoring unit of a first set being uniquely assigned to a respective said item of the set of items. The items may be vehicles, eg. cars, trailers etc., or may be containers, or other items.

Where the mobile location monitoring unit is fitted to an item, the unit may comprise a memory programme to contain information which identifies characteristics of the item.

The mobile location monitoring unit may be arranged to transmit a signal comprising the location information

and information uniquely identifying the control unit and/or an item to which the unit is assigned.

For a better understanding of the invention, and to show how embodiments and methods of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings, in which:

Figure 1 shows in general schematic form a location monitoring apparatus according to a first specific embodiment of the present invention;

Figure 2 shows schematically a first mobile location monitoring unit according to another specific embodiment of the present invention;

Figure 3 shows a second mobile location monitoring unit according to a further specific embodiment of the present invention; and

Figures 4 to 9 show an overview of a method of operating mobile location monitoring unit, according to a specific method of the present invention.

Referring to figure 1 of the accompanying drawings, a location monitoring apparatus comprises a mobile location monitoring unit 1 capable of receiving a satellite navigation signal from a GPS satellite 2 or any other positional information system; and one or a plurality of ground stations 3, the ground stations forming a ground station network, which may also include retail dealerships, sales/installation outlets and/or any information gathering means; and each ground station capable of receiving a location signal containing location

information, from the one or plurality of mobile location monitoring units, the ground station 5 also optionally capable of receiving the satellite navigation signal; and a communication link between the plurality of mobile location monitoring units and the one or plurality of ground stations. The communications link may comprise a cellular telephone network, a citizens band radio network, or similar.

Each ground station preferably comprises a personal computer having an internal database memory for storing information on a database. Examples of the information stored may include information on types of vehicle, vehicle registration numbers, ownership of vehicles, details of services in the immediate geographical vicinity of the ground station, eg. windscreen repair services, hospital services, locations of police stations and/or any customer specific service requirement details. The personal computer of the ground station stores a location map covering locations and can also store a general post office addressing system and is capable of producing an image of the geographical location upon a monitor comprising the personal computer, and/or of displaying details of the location according to the postal addressing system.

The plurality of mobile location monitoring units, each transmit a location information signal to the ground station, the location information signal including information which uniquely identifies the particular mobile location monitoring unit and its location. The location information signal may be transmitted intermittently, at regular periods, or substantially in real time. The ground station is arranged to receive the location information signals, and store selected portions

of the location information signals at predetermined or presettable times.

For example, in use, a plurality of mobile location monitoring units may be moved around in a particular geographical location, each regularly transmitting their location information over the communications link to a nearest said ground station. The ground station may sequentially log the location information received from each of the mobile location monitoring units, so as to record for each mobile location monitoring unit the identity of the mobile location monitoring unit, the location of the unit at a predetermined time, how long the mobile location monitoring unit stays at that location, so as to be able to produce a record of the precise movements of the mobile location monitoring unit over, for example the past twelve hours. The information may be quite precise, for example the ground station may record the position every time a particular mobile location monitoring unit moves a preset distance, for example three metres. Alternatively, the ground station may record and/or display the location of a particular mobile location monitoring unit at preset intervals, eg. every thirty minutes or whatever preset periodic interval is required by a customer, eg. every second, so as to produce a detailed log and record of the geographical movement of the mobile location monitoring unit.

The mobile location monitoring units may be fixed to, for example, vehicles eg. the trailers in a fleet of articulated lorries. In this application, a respective mobile location monitoring unit may be fitted to each trailer and the position of each particular trailer in a fleet may be substantially continuously monitored and print outs of the movements of the trailers made every

three or four hours. Such information may be useful in determining servicing schedules etc. for trailers, based upon the amount of mileage the trailer has travelled, or may be used to determine whether the correct tractor has coupled to the correct trailer or vice versa.

Referring to figure 2 of the accompanying drawings, a first mobile location monitoring unit comprises a GPS receiver 10, for identifying the geographical location of the mobile location monitoring unit; a control unit 11 in the form of a micro processor with semiconductor memory, a communications interface 12 for interfacing a signal received from the GPS receiver with the control unit, and for interfacing with an external communications link, a battery power supply, and/or optionally a plug for powering the location monitoring unit from an external electrical power source; and a transponder 14.

The external communications link may comprise a telephone line, eg. a cellular telephone line and may have an optional telephone handset 13.

The micro processor may be programmed by a detachable computer eg. a lap top computer, or by a keyboard/key pad 50 or may be remotely programmed from a ground station via the communications link. The mobile location monitoring unit may have a number of separate communications interfaces, for example an RS232 bus, which are capable of receiving inputs from a plurality of sensors. For example where the first mobile location monitoring unit is fitted to a tractor unit of an articulated lorry, there may be provided a plurality of sensors around the tractor unit which feed information into the mobile monitoring location unit. For example a brake fluid level sensor, a brake pad wear indicator sensor, an engine oil level sensor etc. may

all regularly or intermittently transmit information on the condition of the sensor parameters to the mobile location monitoring unit. The control unit of the mobile location monitoring unit may the compare these parameters with predetermined parameters, and if any parameter falls outside a predetermined parameter, the mobile location monitoring unit may transmit information relating to the sensed parameters to the ground station. For example, if the hydraulic brake fluid on a tractor unit falls below a predetermined level, the control unit may compare the signal from the hydraulic brake fluid sensor with a predetermined value and if the signal falls below the predetermined value, and may transmit a signal to the ground station, indicating that a certain tractor to which the mobile location monitoring unit is attached, has a low hydraulic brake fluid level.

The mobile location monitoring units are not restricted to vehicular application. Individual mobile location monitoring units may be firmly attached to trailers, pieces of plant or equipment, containers for shipment or any similar product for which the location needs to be regularly monitored, optionally in combination with other sensed parameters, eg. temperature.

Referring to figure 3 of the accompanying drawings, there is shown a second mobile location monitoring unit. The second mobile location monitoring unit comprises a GPS receiver 20 receiving a satellite navigation signal from an antennae 21; a communications interface 22, which may receive a signal from the GPS receiver via a transmission line eg. an RS232 bus 23; a location signal from the GPS receiver being passed via the communications interface to a control unit 23, the control unit 23 capable of transmitting a location information signal via a second

communications interface 24, a modem 25, and a cellular telephone transceiver and adapter 26, to a remote ground station over a conventional cellular telephone network. The control unit 23 may be programmable using a key pad 27, or lap top computer or remotely by the ground station via the communications link. The control unit includes a programmable read only memory 28, a dynamic random access memory 29, and a static random access memory 30, in which may be stored various parameters according to the particular application of the mobile location monitoring unit.

There may be provided a further communications interface to enable the control unit to control a fax machine, Email facility, or conventional voice telephone line.

Referring to figures 4 to 8 of the accompanying drawings, there will now be described further aspects of a method of operation of the second mobile location monitoring unit of figure 3, and of a location monitoring system according to a specific embodiment and method of the present invention.

The mobile location monitoring units are designed to operate in conjunction with ground station. A ground station maintains databases containing information about eg. the vehicles together with OS maps, street plans and other databases relevant to the application. For example, a mobile location monitoring unit is able to be tracked in real-time and displayed as an ICON superimposed on an OS map image of an area, together with displayed postal address information.

Typical applications will include the following:

i) Real time tracking of stolen vehicles/boats.
ii) Monitoring of goods vehicle journeys.
iii) Train journey progress monitoring.
iv) Emergency call-outs from within a vehicle.
v) Accident analysis.
vi) Provision of data to relevant institutions eg. the NRA (National Rivers Authority) for chemical spillages in real time.

GPS receiver and interface

The GPS receiver is a commercially available unit used principally in marine applications such as ship navigation. It uses GPS (Global Positioning System) satellites in geo-stationary orbit to determine the latitude and longitude of the unit to within ten metres accuracy. This module outputs predetermined data packets containing positional and satellite information as a 20mA data stream.

The 20mA/RS232 module converts the signals into RS232 signals able to be recognised by the UART circuitry of the Comms. Interface which provides the link to the processor unit.

Cellnet mobile location monitoring unit and interface

The Cellnet unit is based upon a commercially available Cellnet mobile phone. This is interfaced via a Cellnet adapter to a V42bis modem unit which is able to be controlled via another comms. Interface module. This provides the capability of bi-directional communications with a ground station and allows the unit to dial-up or answer incoming calls from the ground station, or ordinary voice phone calls.

Keypad

This is a conventional matrix keyboard which allows the user to arm or disarm the unit, change the security code (PIN) or request services. Typically it will consist of the numeric keys together with the function keys for the following:

i) Arm
ii) Disarm
iii) PIN change
iv) Clear
v) Service(s)
vi) Any number of approved input/output devices

Processor mobile location monitoring unit and memory

This module is responsible for controlling all the other modules via the comms, interfaces and the keyboard port.

The PROM 28 (Programmable Read Only Memory) contains the control software which drives the functioning of the mobile location monitoring unit itself. The Dynamic RAM 29 is used to store all run-time data except the PIN number, Arm Status and Arm Position; this information must never be lost (even if all power is lost) and is therefore stored in the non-volatile Static RAM 30.

Functional Overview

The basic functionality of the system is that of positional monitoring. The ground station can call up any mobile location monitoring unit for positional information, allowing the mobile location monitoring unit to be tracked in real-tim. The mobile location monitoring unit can also initiate communications if for example the mobile location monitoring mobile location monitoring unit

moves after it has been "armed" by the user and/or automatically, thereby raising an alarm to the system regarding a possible theft. Other extensions to the basic functionality include the ability to call up the ground station for various services, for example vehicle breakdown service call outs.

All interaction with the user is via a small keypad which is used to enter commands to the mobile location monitoring unit together with a user specified security code (PIN number) and/or possibly a telephone for normal phone calls. Most commands are single key strokes for reasons of simplicity.

The control software itself is stored on the PROM (programmable read only memory) chip(s) on a processor board. Each mobile location monitoring unit has a totally unique identity in the form of a number of predefined characters which is also stored on the PROM and therefore cannot be altered. This mobile location monitoring unit identification is used as the key to all information about the host vehicle to which the mobile location monitoring unit is attached. The information is held centrally on a ground station and includes data such as the name and address of the mobile location monitoring unit owner and all the host item details.

Kernel process

The Kernel process carried out in the control software can be seen on every data flow diagram of figures 3 to 8 herein. This process is responsible for sharing the processor time between the other processes within the software. This ensures that all processes are serviced on a regular basis thereby avoiding bottlenecks within the software. The only processes which are not directly

handled by the Kernel are Comms, Handlers; these are interrupt driven such that they never miss a character received via the Communications ports.

GPS Processing

The GPS Rx Stream is a continuous stream of data from the GPS Receiver which is received one character at a time by the Comms. Handler process and/or a dedicated serial port. This process is interrupt driven and therefore does not need to be controlled by the Kernel process. This process receives GPS data and stores it in the GPS Receiver Buffer.

The GPS data is punctuated by special characters which enables the Packet Builder process to logically divide up the stream into "GPS Packets" for input to the Packet Parser process.

The Packet Parser interprets the GPS Packets and extracts the relevant information for the functioning of the mobile location monitoring unit. Current positional data such as the latitude, longitude, speed and direction is recorded together with the satellite status (eg. which satellites are being received and what quality of position is being calculated). Each movement is recorded in the historical position log. This stores movements on a diminishing resolution basis; ie. the most recent positions are on a second by second basis, whereas the older logs are separated by minutes.

Keypad processing (Fig. 5)

The keypad is the main interface with the user; the keypad data stream is simply the sequence of keys being pressed by the user. The command builder constructs user

commands by recognising the syntax of commands within the data stream.

When the arm command is recognised the current positional data is read and the position is recorded in the arm position for subsequent monitoring. The arm status is also updated to indicate the mobile location monitoring unit is indeed armed.

The disarm command simply updates the arm status to indicate that the mobile location monitoring unit is no longer armed and hence the monitoring of the current and armed positions is disabled.

Arming and disarming is only allowed when a valid PIN number is entered with the command. This PIN number can be altered by the user via the "Change PIN" function which re-codes the most recent PIN number. Periodic and/or irregular PIN change may be reported to a control centre.

Base station command processing (Fig. 6)

In a similar fashion to the GPS processing, the network Rx stream is received on character at a time by an interrupt driven comms. Handler process which stores the information in the command buffer. The stream consists of commands from the ground station and protocoling information from the modern mobile location monitoring unit, and follows a rigid syntax. This allows the command builder process to logically divide up the stream into "controller commands" for input to the command interpreter process.

Based upon the actual command received, the command interpreter invokes other processes to carry out the tasks required. The start and stop commands are the means by

which the ground station starts and stops the real time tracking function. These commands update the tracking status to indicate whether or not tracking is required.

Protocol information such as the connection type and transfer rate (returned by the modem) are handled by the connection process and are used to update the link status.

Alarm processing (Fig. 7)

The movement monitor is driven by the arm status information; if the mobile location monitoring unit is not "armed" this process may be overridden by an automatic default arming process. If the mobile location monitoring unit is armed however, the current positional data is continuously compared with the arm position in order to determine if the mobile location monitoring unit has moved. If the mobile location monitoring unit has moved from its arming position whilst still armed it is assumed that a potential theft is in progress and the generate alarm process is invoked.

The generate alarm process must firstly obtain a communications link with a ground station. This is carried out by the connection handler which instructs the modem (using the industry standard Hayes AT commands) to dial up a ground station and negotiate a connection. Once the link is established the generate alarm process constructs and sends an "alarm packet" to the ground station. Typically the ground station will wish to track the mobile location monitoring unit and will send a "start packet" to invoke the tracking operation.

Tracking processing (Fig. 9)

The tracking process is driven by the tracking status information; if the mobile location monitoring unit is not

in a tracking mode this process is not invoked. If the tracking status is positive however, the current positional data and satellite status information is read, formatted into packets and then sent to the ground station via the modem and Cellnet mobile location monitoring units. Alternatively, if the ground station has requested a historical enquiry, the historical position log is communicated back to the ground station rather than the current positional data.

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features

disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A location monitoring apparatus characterised by comprising:

(i) a plurality of mobile location monitoring units;

(ii) one or a plurality of ground stations;

(iii) a communications link between the mobile location monitoring unit and the ground station(s);

wherein each ground station is arranged to receive location information from one or more of the mobile location monitoring units, said location information corresponding to the location(s) of said respective mobile location monitoring unit(s), and

each said ground station is capable of identifying the location(s) of the one or more said mobile location monitoring unit(s) on a geographical map stored by the ground station and/or of identifying said location(s) by a general geographical address system.

2. A location monitoring apparatus according to claim 1, characterised in that the ground station is arranged to present the geographical map as a map image.

3. A location monitoring apparatus according to claim 2, characterised in that the ground station is capable of displaying the location(s) of the one or more mobile monitoring units on the image on the geographical map.

4. A location monitoring apparatus according to any one of the preceding claims, characterised in that said location information is communicable between the mobile location monitoring unit(s) and the ground station(s) substantially in real time.

5. A location monitoring apparatus according to any one of the preceding claims, characterised in that the ground station is adapted to determine from the movement of a said mobile location monitoring unit a speed and/or direction, of that particular mobile location monitoring unit in real time, or on a historical basis.

6. A location monitoring apparatus according to any one of the preceding claims, characterised in that a said mobile location monitoring unit is capable of storing location information relating to its location, and communicating said location information to the ground station(s) on receipt of a request from a said ground station.

7. A location monitoring apparatus according to any one of the preceding claims, characterised in that a said ground station comprises a computer arranged to receive the location information via the communications link.

8. A location monitoring apparatus according to any one of the preceding claims, characterised in that a said ground station comprises a database of information.

9. A location monitoring apparatus according to claim 8, characterised in that said information is selectively accessible from a said mobile location monitoring unit via said communications link.

10. A location monitoring apparatus according to any one of the preceding claims, wherein each said mobile location monitoring unit is capable of storing an identification code uniquely identifying said particular mobile location monitoring unit, and is arranged to transmit said unique identifying code along with said location information.

11. A mobile location monitoring unit comprising:

(i) a location identification means for identifying a geographical location of the unit and for generating a location information relating to said geographical location;

(ii) a communication means for communicating a location information with one or a plurality of ground stations; and

(iii) a control means for controlling the communication means for communicating the location information with the one or plurality of ground stations.

12. A mobile location monitoring unit according to claim 11, characterised in that said location identification means for identifying a geographical location comprises a receiver capable of receiving satellite navigation signals.

13. A mobile location monitoring unit according to claim 11 or 12 characterised in that the location identification means comprises a receiver capable of locating a position in relation to an existing node network.

14. A mobile location monitoring unit according to any one of claims 11 to 13, characterised in that said communication means comprises an interface capable of connecting to a communications link.

15. A mobile location monitoring unit according to claim 14, characterised in that said communications link comprises a cellular telephone network.

16. A mobile location monitoring unit according to any one of claims 11 to 15, comprising a recorder for recording the location information.

17. A mobile location monitoring unit according to claim 16, in which said recorder comprises a semi conductor memory.

18. A mobile location monitoring unit according to any one of claims 11 to 17, as appendant on claim 16, characterised in that the said location identification means operates to supply the location information to the recorder and/or the communication means substantially continuously.

19. A mobile location monitoring unit according to claim 16, 17 or 18, characterised in that the recorder operates to record the location information at predetermined times.

20. A mobile location monitoring unit according to any one of claims 16 to 19, characterised in that the recorder operates to record the location information at regular time intervals.

21. A mobile location monitoring unit according to any one of claims 16 to 20, characterised in that the recorder is adapted for storing customer specific information.

22. A mobile location monitoring unit according to any one of claims 11 to 21, characterised in that the control unit operates to activate the communications means to communicate the location information to the one or plurality of ground stations at predetermined regular time intervals.

23. A mobile location monitoring unit according to any one of claims 16 to 22, characterised in that said control unit operates to activate the communications means such as to produce substantially continuous transmission of the location information to the one or plurality of ground stations.

24. A mobile location monitoring unit appendant to any one of claims 16 to 21, characterised in that said control unit is arranged to operate the recorder means so as to record said location information together with a time information such that there is recorded:

(i) a location information relating to a set of separate locations in which the unit has been present; and

(ii) a time information comprising a separate time period information relating to each of the said separate locations, such that for each said location at which the unit has visited, there is recorded a respective time period over which the unit remained at the location.

25. A mobile location monitoring unit according to any one of the preceding claims 16 to 24, in which a said ground station comprises a computer.

26. A mobile location monitoring unit according to claim 25, in which said computer comprises a database containing information relating to a set of items and a plurality of the mobile location monitoring units, each said mobile location monitoring unit of a first set being uniquely assigned to a respective said item of the set of items.

27. A mobile location monitoring unit according to any one of claims 16 to 26, characterised by comprising a memory programmed to contain information which identifies characteristics of the item.

28. A mobile location monitoring unit according to any one of claims 16 to 27, characterised by being arranged to transmit a signal comprising the location information and information uniquely identifying the control unit and/or an item to which the unit is assigned.

29. A mobile location monitoring apparatus substantially as herein described with reference to the accompanying drawings.

30. A mobile location monitoring unit substantially as herein described with reference to the accompanying drawings.

The Patent Office

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Application No: GB 9520208.1 **Examiner:** Dr E P Plummer
Claims searched: all **Date of search:** 21 May 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): H4D

Int Cl (Ed.6): G01S

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP0528090A1	CAE-Link Corp whole document	1-4,7, 8,10-18, 21,23, 25-28
X	EP0509777A2	Pioneer Electronic Corp whole document	1,4-12, 14,16,17, 21,25-28
X	WO95/29410A1	General Electric Co whole document	1,4,10-14,19,20, 27,28
X	US5392052	Eberwine whole document	1,4, 6-12,14, 16,17,21, 25-28
X	US5389934	The Business Edge Group whole document	1,4,7, 11-15,22, 23,25-27

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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